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# Evaluating the AD5545 Current Output/Serial Input DAC

## FEATURES

**Full-featured evaluation board for the AD5545**
**Graphic user interface software for board control and data analysis**
**Connector to EVAL-SDP-CB1Z system demonstration platform board**
**Various power supply options**

## APPLICATIONS

**Automatic test equipment**
**Instrumentation**
**Digitally controlled calibration**

## GENERAL DESCRIPTION

The AD5545 dual, 16-bit, current output, digital-to-analog converter (DAC) is designed to operate from a single 5 V supply with bipolar output up to ±15 V capability.

The applied external reference input voltage ($V_{REF}$) determines the full-scale output current. Integrated feedback resistors ($R_{FB}$) provide temperature-tracking, full-scale voltage outputs when combined with an external I-to-V precision amplifier.

A double-buffered serial data interface offers high speed, 3-wire, SPI-compatible, and microcontroller-compatible inputs using serial data in (SDI), chip select ($\overline{CS}$), and clock (CLK) signals. A common, level-sensitive, load DAC strobe ($\overline{LDAC}$) input allows the simultaneous update of all DAC outputs from previously loaded input registers. Additionally, an internal power-on reset forces the output voltage to 0 at system turn-on. An MSB pin allows system reset assertion ($\overline{RS}$) to force all registers to zero code when MSB = 0, or to half-scale code when MSB = 1.

The AD5545 is packaged in the compact 16-lead TSSOP.

The EVAL-AD5544/45SDZ board is used in conjunction with the EVAL-SDP-CB1Z system demonstration platform (SDP) board available from Analog Devices, Inc., which is purchased separately from the evaluation board. The USB-to-SPI communication to the AD5545 is completed using the EVAL-SDP-CB1Z Blackfin®-based demonstration board.

## FUNCTIONAL BLOCK DIAGRAM

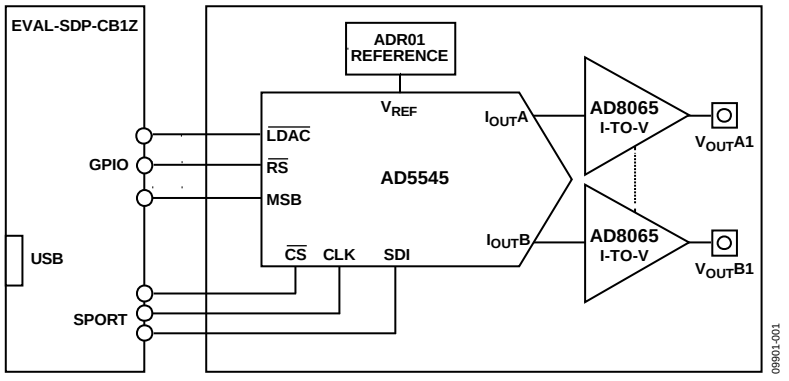


*Figure 1.*

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## REVISION HISTORY

**2/12—Rev. 0 to Rev. A**

Replaced Evaluation Board Schematics and Artwork Section ... 5

**8/11—Revision 0: Initial Version**

# EVALUATION BOARD SOFTWARE

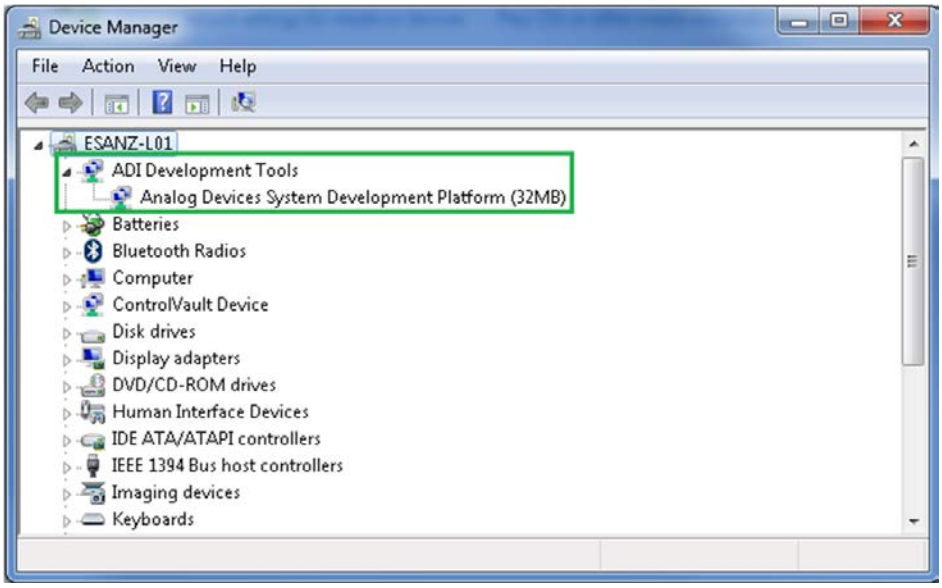


*Figure 2. Device Manager Showing the SDP Board Connected*

## INSTALLING THE SOFTWARE

The EVAL-AD5544/45SDZ evaluation kit includes the software and drivers on CD. To install the software, follow these steps:

1. Install the software before connecting the SDP board to the USB port of the PC.
2. Start the Windows operating system and insert the EVAL-AD5544/45SDZ evaluation kit CD.
3. Download the EVAL-AD5544/45SDZ LabVIEW™ software. The correct driver, SDPDriversNET, for the SDP board should download automatically after LabVIEW is downloaded, supporting both 32- and 64-bit systems. However, if the drivers do not download automatically, the driver executable file can also be found in the **Program Files/Analog Devices** folder. Follow the on-screen prompts to install it.
4. After the installation of the software and drivers is complete, plug the EVAL-AD5544/45SDZ into the SDP board and the SDP board into the PC using the USB cable included in the box.
5. When the software detects the evaluation board, proceed through any dialog boxes that appear to finalize the installation (**Found New Hardware Wizard/Install the Software Automatically** and so on).

## RUNNING THE SOFTWARE

To run the evaluation board program, do the following:

1. Click **Start/All Programs/Analog Devices/EVAL-AD5544_45SDZ.**
2. If the SDP board is not connected to the USB port when the software is launched, a connectivity error displays (see Figure 3). Simply connect the evaluation board to the USB port of the PC, wait a few seconds, click **Rescan**, and follow the instructions.

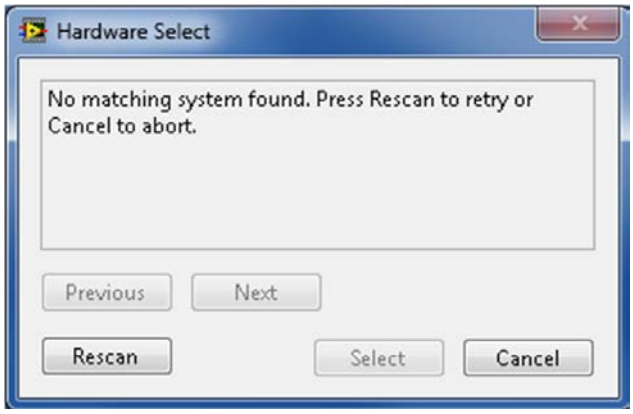


*Figure 3.*

# USING THE EVALUATION BOARD SOFTWARE

Once the software is launched, the main window pops up (see Figure 4).

*Figure 4. Main Window*

The first step is to select the device to use which is connected to the SDP board, in this case the AD5545, and click the **OK** button.

After selecting the device, the AD5545 evaluation software window appears (see Figure 5) to allow writing on the device.

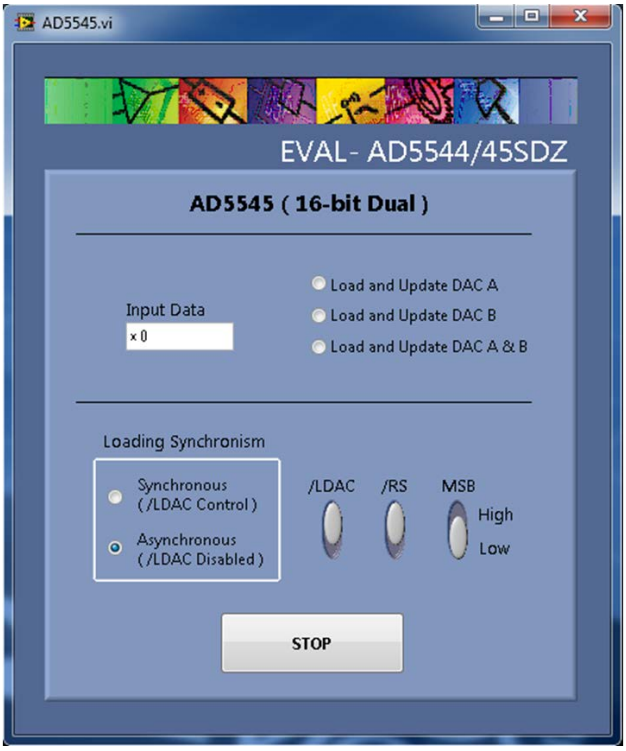


*Figure 5. AD5545 Evaluation Software Window*

The desired 16-bit data loads and updates one of the four DACs selected by the user within the AD5545 part.

There are two modes for loading the data. The first one is synchronous mode where you can program each channel separately but update them simultaneously. Program $\overline{\text{LDAC}}$ high, load the channels and finally pull $\overline{\text{LDAC}}$ low. The asynchronous mode enables you to load and update each channel separately (the $\overline{\text{LDAC}}$ button is ignored in this case).

The reset button, $\overline{\text{RS}}$, updates all channel outputs to zero scale or midscale when MSB is pulled low or high.

## EXAMPLE

With $\overline{\text{LDAC}}$ and $\overline{\text{RS}}$ tied high for asynchronous loading mode, specify quarter scale (0x4000, 16384d) in the **Input Data** box and click **Load and Update DAC A.** The expected output obtained is

$$V_{OUT} = -V_{REF} \times \frac{D}{65{,}536} = -10 \times \frac{16{,}384}{65{,}536} = -2.5\ \text{V}$$

When you change the loading synchronism mode to synchronous and write the value 0xC000 (49152d), you see no change in the output until $\overline{\text{LDAC}}$ is tied low. The expected output for this case is

$$V_{OUT} = -V_{REF} \times \frac{D}{65{,}536} = -10 \times \frac{49{,}152}{65{,}536} = -7.5\ \text{V}$$

# EVALUATION BOARD SCHEMATICS AND ARTWORK

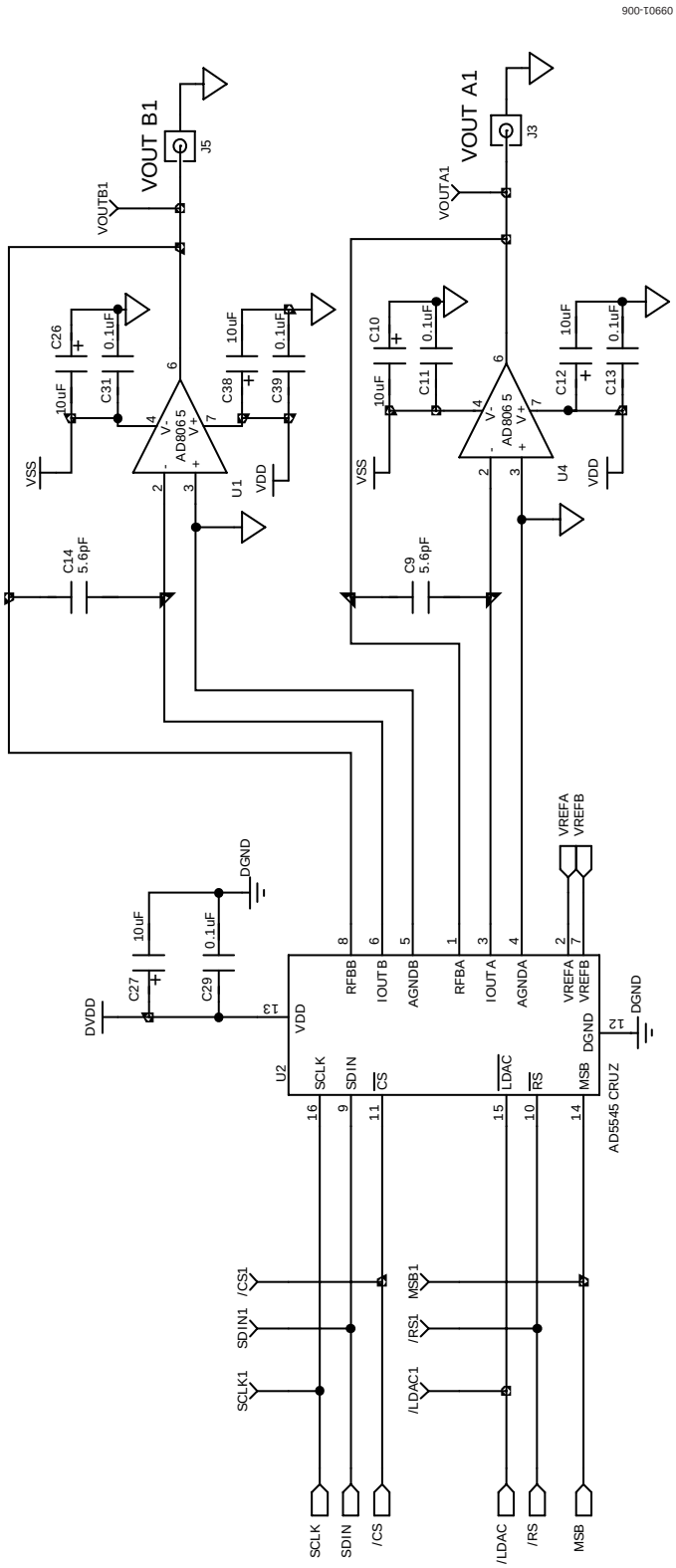


*Figure 6. EVAL-AD5544/45SDZ Schematic Part A*

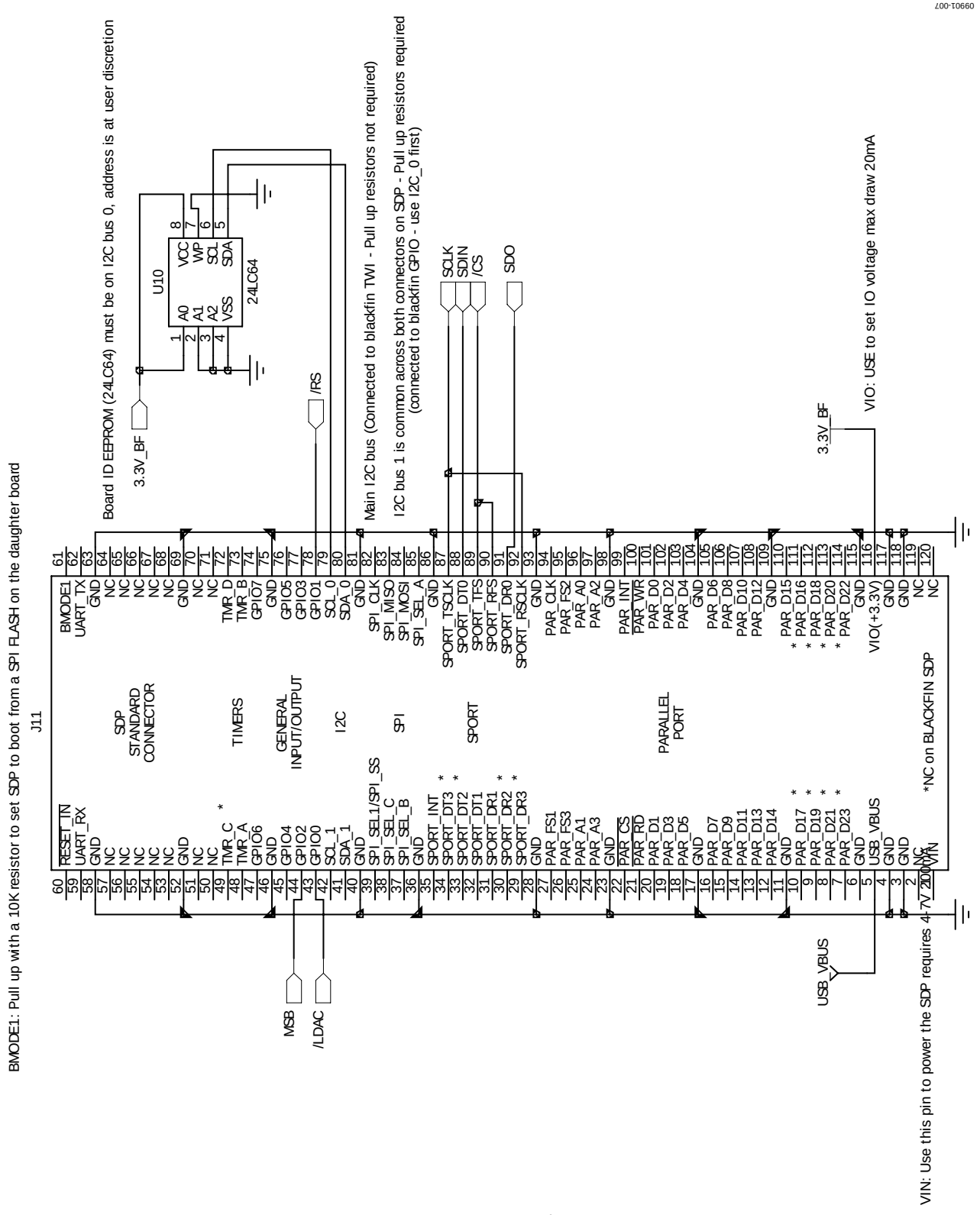
BMODE1: Pull up with a 10K resistor to set SDP to boot from a SPI FLASH on the daughter board
J11
SDP STANDARD CONNECTOR
TIMERS
GENERAL INPUT/OUTPUT
I2C
SPI
SPORT
PARALLEL PORT
Board ID EEPROM (24LC64) must be on I2C bus 0, address is at user discretion
U10
24LC64
3.3V_BF
/RS
Main I2C bus (Connected to blackfin TWI - Pull up resistors not required)
I2C bus 1 is common across both connectors on SDP - Pull up resistors required (connected to blackfin GPIO - use I2C_0 first)
SCLK
SDIN
/CS
SDO
VIO: USE to set IO voltage max draw 20mA
MSB
/LDAC
USB_VBUS
VIN: Use this pin to power the SDP requires 4-7V 200mA
*NC on BLACKFIN SDP
09901-007

*Figure 7. EVAL-AD5544/45SDZ Schematic Part B*

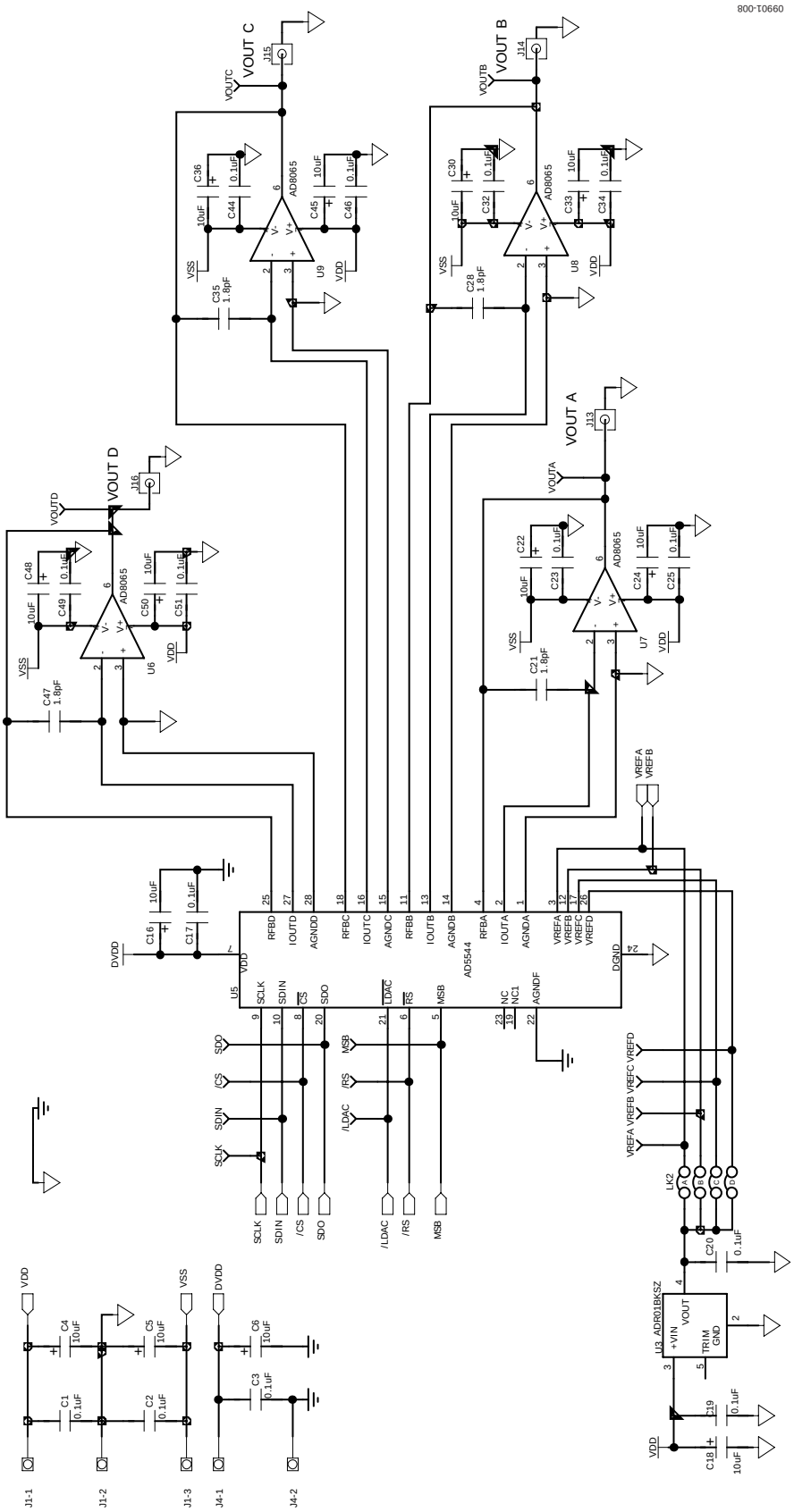


*Figure 8. EVAL-AD5544/45SDZ Schematic Part C*

## EVALUATION BOARD LAYOUT

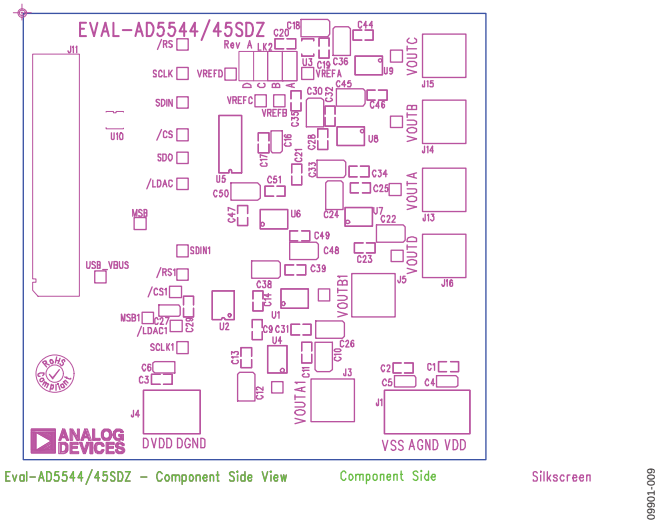


*Figure 9. Silkscreen*

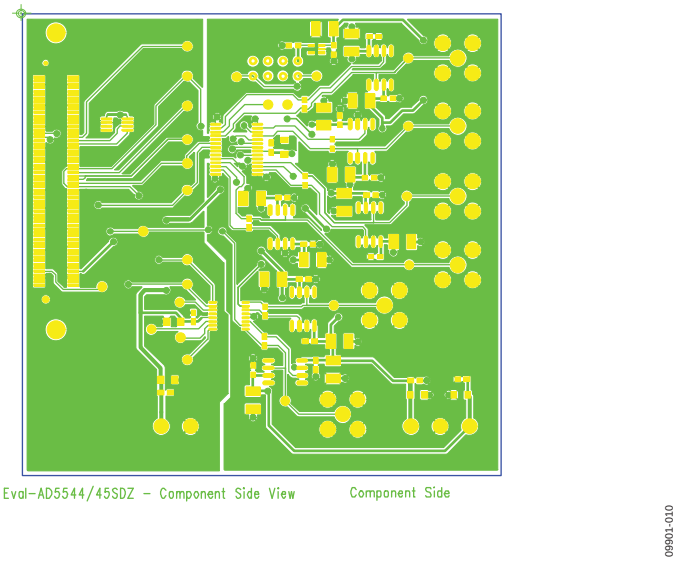


*Figure 10. Component Side*

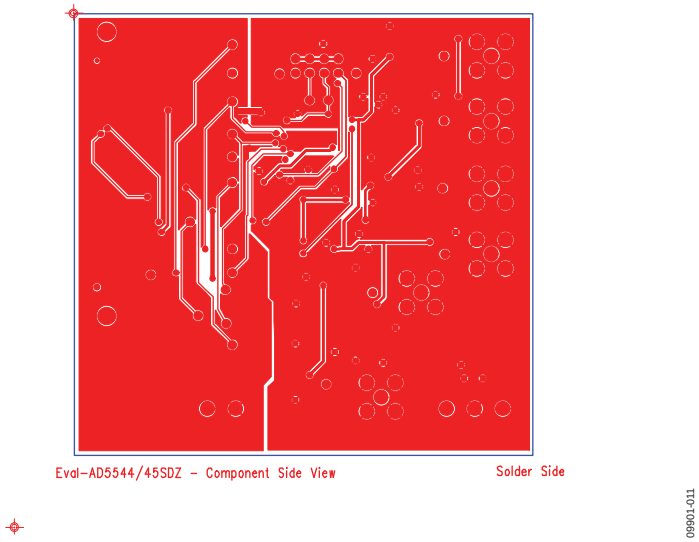


*Figure 11. Solder Side*

## RELATED LINKS

| Resource | Description |
|---|---|
| AD5545 | Product Page, AD5545 Precision Dual 16-Bit DAC in compact TSSOP Packages |
| AD5544 | Product Page, AD5544 Quad, Current-Output, Serial-Input 16-Bit DAC |
| ADR01 | Product Page, ADR01 Ultracompact, Precision 10.0V Voltage Reference |
| AD8065 | Product Page, AD8065 High Performance, 145 MHz *FastFET*™ Op Amp |
| EVAL-SDP-CB1Z | Product Page, System Demonstration Platform |

## NOTES

## NOTES

# NOTES

**ESD Caution**

**ESD (electrostatic discharge) sensitive device**. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

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